

REMARKS

This paper is filed in response to the non-final Office action mailed on February 13, 2009. No claims are amended. Claims 68-63 and 79-90 remain pending in the application. Applicant appreciates the Examiner's allowance of claims 85 and 87 and his indication that claims 71, 72, 82 and 83 recite allowable subject matter. In view of the following comments, Applicant respectfully requests reconsideration and allowance of all pending claims.

Claim Rejections – 35 U.S.C. §103

In the outstanding Office action, claims 68-70, 73, 79-81, 84, 86, and 88-90 stand rejected under 35 U.S.C. §103 as being unpatentable over combinations of the prior art. However, to support an obviousness rejection, MPEP §2143.03 requires "all words of a claim to be considered" and MPEP § 2141.02 requires consideration of the "[claimed] invention and prior art as a whole." Further, the Board of Patent Appeals and Interferences recently confirmed that a proper, post-*KSR* obviousness determination still requires the Office to make "a searching comparison of the claimed invention – including all its limitations – with the teaching of the prior art." *See, In re Wada and Murphy*, Appeal 2007-3733, citing *In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995). Applicant submits that none of the proposed combinations of the prior art discloses every limitation of the pending claims, thereby overcoming the aforementioned rejections, as discussed more specifically below.

Claims 68 and 79 were rejected as being obvious over the proposed combination of U.S. Patent No. 5,671,608 ("Wiggs") and U.S. Patent No. 3,872,682 ("Shook"). Each of independent claims 68 and 79 requires a direct expansion geothermal heat exchange system having a heating mode and a cooling mode. The geothermal heat exchange system requires at least an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in the cooling mode of approximately 305-405 psi and a suction pressure in the heating mode of approximately 80-160 psi. The proposed combination of Wiggs and Shook fails to teach or suggest all of these limitations.

Wiggs is directed toward direct expansion systems near surface conditions which use conventional refrigerants at conventional operating pressures in the heating and cooling modes and is unrelated to sub-surface heat exchange systems of the present application. More specifically, a conventional R-22 system will typically have a head pressure in the cooling mode

of approximately 200-250 psi, and a suction pressure in the heating mode of approximately 50-70 psi. As disclosed in paragraph [0024] of the present application, such conventional refrigerants work well near surface conditions, typically at depths of 100 feet or less, but not for sub-surface heat exchange applications extending to depths beyond 100 feet. At such depths, a refrigerant with a greater operating pressure must be utilized so as to offset the negative effects of gravity. As the Examiner admittedly states on page 2 of the Office action, Wiggs fails to teach or suggest such refrigerant charge parameters, as specified in claims 69 and 79.

Shook fails to provide the deficiencies of Wiggs '608 noted above. The Examiner's comments regarding Shook are confusing, inaccurate, and fail to address each element of the claims, as discussed in greater detail below.

First, the Examiner's comments regarding Shook are unclear as to exactly what the Examiner believes is taught in Shook. More specifically, the Examiner alleges that Shook teaches, "...the use of head pressure in the range of 5 atmosphere [sic] (73.5 psia) to 30 atmosphere [sic] (441 psia) to 700 psia head (See column 6, lines [sic] 7-21)." From this statement, it is difficult to identify what range or ranges the Examiner indicates is taught in Shook, let alone how the purported range(s) relate to the currently claimed subject matter.

Second, the Examiner relies on his confusing characterization of Shook to incorrectly argue that Shook teaches a desired head pressure range of 73.5 psi to 700 psi. At no point does Shook disclose such a range, and Shook actually teaches away from the use of head pressures in the Examiner's specified range. More specifically, the excerpt from Shook cited by the Examiner states:

The use of exotic refrigeration apparatus in this invention is not necessary. The compressor (e.g., a positive displacement type) or other compressing system (e.g., a gas fired compression system) can generally be the same type used in air conditioning systems. Preferably, the compressor can provide at least 5 atmospheres pressure but need not provide 700 p.s.i.a. or more, as is the case with most closed cycle refrigerant systems using carbon dioxide. For example, 30 atmospheres pressure or less is ordinarily sufficient. The suction pressure in the evaporator need not be anywhere near the 300 p.s.i.a. commonly used in closed cycle carbon dioxide refrigeration systems; 5 atmospheres or less will provide temperatures well below -55° C. and typically below -65° C. (Shook, Col. 6, lines 7-21)

Thus, the foregoing excerpt from Shook makes no mention of a range of head pressures of 305-405 psi as specified in claims 68 and 79. Furthermore, Shook teaches away from the Examiner's proposed head pressure range when it states that the system **"need not provide 700 psia or more."** (emphasis added) Consequently, Shook does not disclose or teach the head pressure range now suggested by the Examiner.

Third, the Examiner also incorrectly contends that Shook teaches the use of a suction pressure of 80-160 psi. The Examiner alleges that the same excerpt from Shook noted above supports the contention that Shook teaches "a desired suction pressure within the range of 73.5 psia to 300 psia." Shook, however, fails to disclose or suggest such a suction pressure range and, in fact, teaches away from the Examiner's proposed range. In the excerpt provided above, Shook clearly states that the suction pressure **"need not be anywhere near"** 300 psia (emphasis added), and therefore directly contradicts the Examiner's position. Other portions of Shook, such as column 2, lines 63-65 and column 4, lines 13-14, teach an even lower suction pressure of "below 3 atmospheres." Thus, Shook clearly and unambiguously teaches a suction pressure of less than 5 atmospheres, and preferably less than 3 atmospheres. Not only does this contradict the Examiner's characterization of what is disclosed in Shook, it teaches away from the currently claimed suction pressure range of 80-160 psi.

Fourth, the rejection as stated by the Examiner fails to adequately address that the claimed suction pressure range is in the heating mode. Shook discloses a refrigeration system that does not have a heating mode. Consequently, it is improper for the Examiner infer any teaching from Shook regarding suction pressure in a system operating in a heating mode when Shook is incapable of operating in such a mode.

The rejection of claims 68 and 79 based on the proposed combination of Wiggs '608 and Shook is deficient for each of the reasons stated above, and therefore reconsideration and withdrawal of the rejection are respectfully requested.

Claims 69, 80, 89 and 90 were rejected as being obvious over the purported combination of Wiggs, Shook, and U.S. Patent No. 6,390,183 ("Aoyagi"). As previously discussed with respect to independent claims 68 and 79, each of claims 69, 80, 89 and 90 similarly requires a direct expansion geothermal heat exchange system having an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in the cooling

mode of approximately 305-405 psi and a suction pressure in the heating mode of approximately 80-160 psi. No combination of Wiggs, Shook, and Aoyagi teaches or suggests all of these limitations.

The combination of Wiggs and Shook has been previously discussed as failing to properly combine, and further, as failing to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Aoyagi similarly fails to supply all of the deficiencies of Wiggs, Parker and Richardson.

The Examiner relies upon Aoyagi for its use of an R-410A refrigerant. However, Aoyagi still fails to supply a direct expansion geothermal heat exchange system having a refrigerant charged to the parameters specified in the claims. In fact, Aoyagi teaches away from charging or operating a heat exchange system at refrigerant pressures greater than those used with a conventional R-22 refrigerant. Instead, Aoyagi teaches that pressure loss experienced by a refrigerant flowing through the heat exchanger should be minimized. Specifically, Aoyagi states that the refrigerant should have a greater density so that a lower refrigerant flow velocity may be used to achieve the same operational abilities as conventional R-22. The lower refrigerant flow velocity, in turn, reduces fluid pressure loss, which is the stated goal of Aoyagi. Furthermore, column 3, lines 44-47 and column 4, lines 16-18 of Aoyagi specifically teaches that the refrigerant charge should be reduced. The net effect of these teachings in Aoyagi is a refrigerant having lower operational pressures than systems using a conventional R-22 refrigerant. One of ordinary skill in the art, therefore, would not be motivated by Aoyagi to use a refrigerant at elevated pressures.

The proposed combination of Wiggs, Shook, and Aoyagi fails to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Accordingly, the obviousness rejection of claims 69, 80, 89 and 90 based upon Wiggs, Shook, and Aoyagi must fail and should be withdrawn.

Claims 70 and 81 were rejected as being obvious over the purported combination of Wiggs, Shook, and Suzuki. As previously discussed with respect to independent claims 68 and 79, each of claims 70 and 81 requires a direct expansion geothermal heat exchange system

having an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. No combination of Wiggs, Shook, and Suzuki teaches or suggests all of these limitations.

The combination of Wiggs and Shook has been previously discussed as failing to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Suzuki similarly fails. More specifically, the Examiner relies upon Suzuki for its use of polyester oils as lubricating oil in a climate control system for the purpose of running the climate control system. However, Suzuki is unrelated to sub-surface heat exchange systems, and further, fails to disclose a direct expansion geothermal heat exchange system having a refrigerant with a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi, as specified in the claims.

As the proposed combination of Wiggs, Shook, and Suzuki fails to teach or suggest all of the required limitations of independent claims 68 and 79, the obviousness rejection of claims 70 and 81 based upon Wiggs, Shook, and Suzuki must also fail and should be withdrawn.

Finally, claims 73, 84, 86 and 88 were rejected as being obvious over the proposed combination of Wiggs, Shook, and U.S. Patent No. 3,421,337 ("Johannsen"). As previously discussed with respect to independent claims 68 and 79, each of claims 73 and 84 requires a direct expansion geothermal heat exchange system having an interior air heat exchanger, an exterior subterranean heat exchanger, and a refrigerant having a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi. Each of independent claims 86 and 88 specifies a method of designing a direct expansion geothermal heat exchange system having a cooling mode and a heating mode. The method requires the steps of providing a refrigerant and charging the system with the refrigerant to obtain a peak operational efficiency in the cooling mode with a superheat of approximately 10°F to 25°F, a head pressure in the heating mode of approximately 195 to 275 psi, a suction pressure in the cooling mode of approximately 80 to 160 psi, and a suction/vapor temperature of approximately 37°F to 55°F. Claim 86 requires an R-410A refrigerant while claim 88 requires a

refrigerant with heating/cooling operational working pressures between 80 psi and 405 psi. No combination of Wiggs, Shook, and Johannsen teaches or suggests all of these limitations.

The combination of Wiggs and Shook has been previously discussed as failing to teach or suggest a direct expansion geothermal heat exchange system having a refrigerant charged to have a head pressure in a cooling mode of approximately 305-405 psi and a suction pressure in a heating mode of approximately 80-160 psi, as specified in independent claims 68 and 79. The combination of Wiggs and Shook similarly fails to teach or suggest every element of claims 86 and 88. More specifically, neither Wiggs nor Shook teaches or suggests a sub-surface direct expansion geothermal heat exchange system with an R-410A refrigerant, or a refrigerant having heating/cooling operational working pressure between 80 psi and 405 psi. Wiggs and Shook also fail to teach or suggest a step of charging such a system with a refrigerant to obtain a peak operational efficiency in the cooling mode with a superheat of approximately 10°F to 25°F, a head pressure in the heating mode of approximately 195 to 275 psi, a suction pressure in the cooling mode of approximately 80 to 160 psi, and a suction/vapor temperature of approximately 37°F to 55°F.

Johannsen similarly fails. The Examiner relies upon Johannsen to supply Wiggs and Shook with a superheat of approximately 12°F. However, Johannsen is unrelated to sub-surface heat exchange systems, let alone charging such systems to obtain peak operational efficiency in a cooling mode, as specified in each of claims 86 and 88. Specifically, Johannsen does not obtain a peak operational efficiency in the cooling mode with a superheat of approximately 10°F to 25°F, a head pressure in the heating mode of approximately 195 to 275 psi, a suction pressure in the cooling mode of approximately 80 to 160 psi, *and* a suction/vapor temperature of approximately 37°F to 55°F.

As the proposed combination of Wiggs, Shook, and Johannsen fails to teach or suggest all of the required limitations of independent claims 68, 79, 86 and 88, the obviousness rejection of claims 73, 84, 86 and 88 based upon Wiggs, Shook, and Johannsen must also fail and should be withdrawn.

CONCLUSION

It is submitted that the present application is in good and proper form for allowance. A favorable action on the part of the Examiner is respectfully solicited. If, in the opinion of the Examiner, a telephone conference would expedite prosecution of the subject application, the Examiner is invited to call the undersigned agent.

The Patent Office is hereby authorized to credit any overpayment or charge any deficiency in the fees filed, asserted to be filed, or which should have been filed herewith to our Deposit Account No. 50-3629.

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